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URS OPERATING SERVICES, INC.
START 3 - REGION 8

MEMORANDUM

TO: Steve Way, On-Scene Coordinator, U.S Environmental Protection Agency Region 8

FROM: Jan Christner, Environmental Engineer, START 3, URS Operating Services, Inc.

DATE: September 6, 2010

SUBJECT: St. Louis Tunnel and Treatment Ponds Discharge

This memo summarizes zinc and cadmium concentrations in the St. Louis Tunnel (adit) discharge and treatment pond outfall and the potential impacts of the outfall on water quality in the Dolores River downstream of the treatment pond outfall. The data used for this analysis was taken from the Watershed Plan for the East Fork of the Dolores River in Dolores County prepared by Grayling Environmental dated August 17, 2006 and the Water Quality Assessment (WQA) for the St. Louis Tunnel Discharge prepared by the Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Division (WQCD) dated October 2008. Water quality data for June 2010 was taken from Rico-Argentine St. Louis Tunnel Trip Report prepared by URS Operating Services, Inc. (UOS), dated August 18, 2010. Water Quality Standards (WQS) were calculated as designated in the CDPHE WQCD Regulation Number 34. Concentrations are shown in micrograms per liter (µg/L).

Dissolved Zinc Concentrations

Date	Adit	Outfall
July 2002	3430	410
October 2002	2970	400
October 2003	5190	1120
April 2004	4180	1690
December 2004	4200	3140
June 2010	7700	3900

- There are wide variations in adit discharge chemistry, possibly seasonal.
- Outfall concentrations have increased significantly over time (see attached graphs showing the upward trend in metal concentrations). Even accounting for seasonal variations, the increase is substantial.
- The differential between the adit concentration and the outfall concentration has gradually decreased.
- It would be expected that as time goes on, the zinc concentration at the pond outfall will continue to increase and ultimately approach the adit concentration. Some attenuation of metals is likely to continue, but at some point, the ponds will become a "source" rather than a sink of metals.
- The analysis in the state WQA indicates that a general permit limit would be 729 µg/L for zinc (WQA Table A-17). This calculation assumes the annual low flow for the Dolores River and the annual high adit discharge (3.3 cfs). Outfall concentrations have exceeded this permit limit since October 2003.

- The metal concentration that could be discharged each month without exceeding WQS is shown on Tables A-9 and A-10 in the Water Quality Assessment (WQA).
- Zinc concentrations in the outfall have been greater than the chronic assimilative capacity (Table A-9 in the WQA) since December 2004.

Potential zinc concentrations that might be realized in the Dolores River downstream of the site given the most recent high flow and the most recent low flow concentrations (December 2004 and June 2010, respectively) were calculated using the chronic and acute low flow rates for the Dolores River, St. Louis Tunnel ponds design flows, and background concentrations provided in the WQA, the December 2004 zinc concentrations provided in the Watershed Plan, and the June 2010 zinc concentrations provided in the UOS Trip Report. The calculations assume no attenuation of metals between the pond discharge point and the Dolores River and do not account for pond leakage into the river.

- Given the most current low-flow outfall concentration (December 2004) and the December acute low-flow conditions that were calculated for the WQA ($Q_{upstream}$ – 3.2 cfs, $Q_{outfall}$ = 2 cfs, $C_{upstream}$ = 20 µg/L; $C_{outfall}$ = 3140 µg/L), the concentration in the Dolores River would be 1220 µg/L.

- Given the most current low-flow outfall concentration (December 2004) and the December chronic low-flow conditions ($Q_{upstream}$ – 6.1 cfs, $Q_{outfall}$ = 2 cfs, $C_{upstream}$ = 20 µg/L; $C_{outfall}$ = 3140), the concentration in the Dolores River would be 790 µg/L.

- Given the most current high-flow outfall concentration (June 2010) and the June acute low-flow conditions that were calculated for the WQA ($Q_{upstream}$ – 12.5 cfs, $Q_{outfall}$ = 3.3 cfs, $C_{upstream}$ = 20 µg/L; $C_{outfall}$ = 3900 µg/L), the concentration in the Dolores River would be 830 µg/L.

- Given the most current high-flow outfall concentration (June 2010) and the June chronic low-flow conditions ($Q_{upstream}$ – 13.2 cfs, $Q_{outfall}$ = 3.3 cfs, $C_{upstream}$ = 20 µg/L; $C_{outfall}$ = 3900), the concentration in the Dolores River would be 796 µg/L.

As the ability of the ponds to attenuate metals decreases, the concentrations may increase to levels close to the adit discharge concentrations, resulting in Dolores River zinc concentrations of 1628 µg/L (December acute low flow), 1052 µg/L (December chronic low flow), 1624 µg/L (June acute low flow), and 1556 µg/L (June chronic low flow).

Colorado WQS are based on hardness. In the WQA, a hardness of 247 milligrams per liter (mg/L) was calculated for use in the WQS calculations based on hardness values measured at sampling location COSJDO03-1.4 located downstream of the pond system outfall and the flow data from the USGS gauging station located approximately five miles downstream of the outfall. The WQS for zinc calculated at a hardness of 247 milligrams per liter are 310 µg/L (acute) and 269 µg/L (chronic). The potential Dolores River concentrations shown above are all significantly greater than the acute and chronic WQS. If paired metal concentration/hardness values are used to calculated acceptable concentrations in the Dolores River downstream of the site, the standard could be significantly lower. For example, the hardness in the Dolores River at DR-7, located downstream of the pond system outfall, during December 2004 was 189 mg/L which correlates to WQS of 247 (acute) and 214 (chronic).

Dissolved Cadmium Concentrations

Date	Adit	Outfall
July 2002	13	ND
October 2002	13.8	1.7
October 2003	28.4	4.6

April 2004	19.96	7.73
December 2004	24.5	15
June 2010	52	31

Cadmium concentrations are also a concern. The concerns are similar to those shown above for zinc.

Potential cadmium concentrations that might be realized in the Dolores River downstream of the site given current and possible future conditions were calculated using the chronic and acute low flow rates for the Dolores River, St. Louis Tunnel ponds design flows, and background concentrations provided in the WQA, the December 2004 cadmium concentrations provided in the Watershed Plan, and the June 2010 cadmium concentrations provided in the UOS Trip Report. The calculations assume no attenuation of metals between the pond discharge point and the Dolores River and do not account for pond leakage into the river.

- Given the most current low-flow outfall concentration (December 2004) and the December acute low-flow conditions that were calculated for the WQA ($Q_{upstream}$ – 3.2 cfs, $Q_{outfall}$ = 2 cfs, $C_{upstream}$ = 0.068 µg/L; $C_{outfall}$ = 15 µg/L), the concentration in the Dolores River would be 5.81 µg/L.

- Given the most current low-flow outfall concentration (December 2004) and the December chronic low-flow conditions ($Q_{upstream}$ – 6.1 cfs, $Q_{outfall}$ = 2 cfs, $C_{upstream}$ = 0.068 µg/L; $C_{outfall}$ = 15), the concentration in the Dolores River would be 3.76 µg/L.

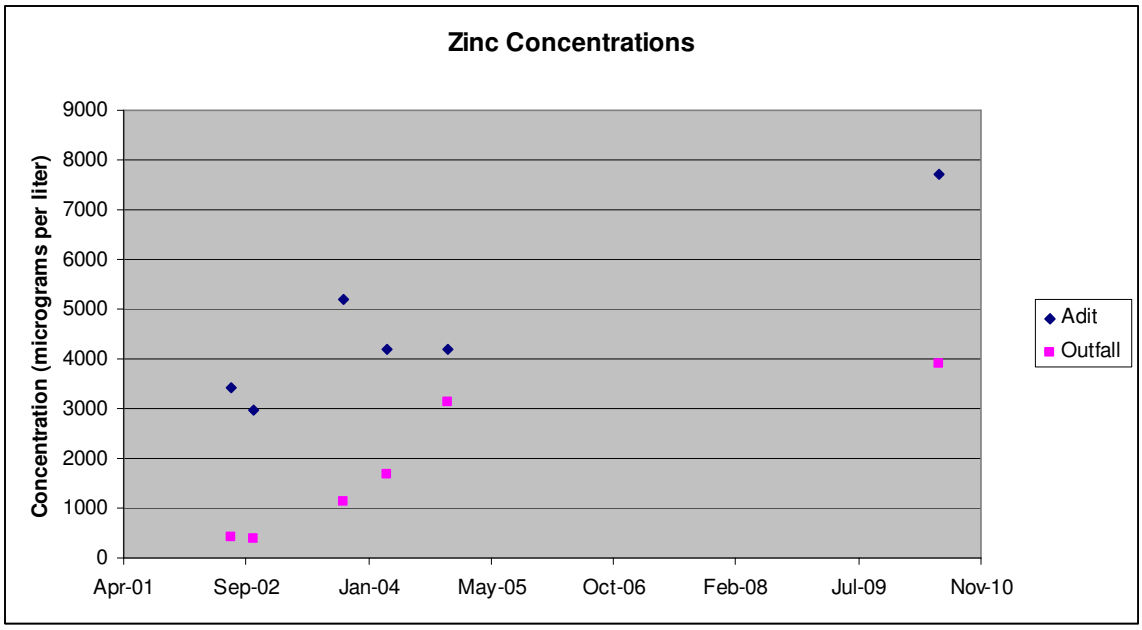
- Given the most current high-flow outfall concentration (June 2010) and the June acute low-flow conditions that were calculated for the WQA ($Q_{upstream}$ – 12.5 cfs, $Q_{outfall}$ = 3.3 cfs, $C_{upstream}$ = 0.068 µg/L; $C_{outfall}$ = 31 µg/L), the concentration in the Dolores River would be 6.53 µg/L.

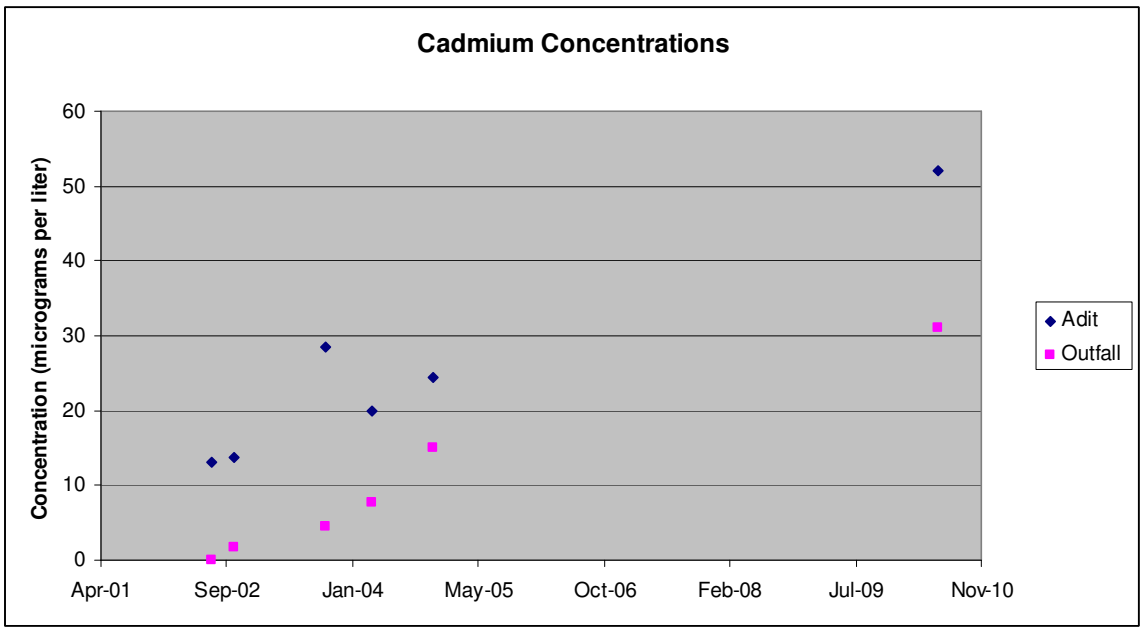
- Given the most current high-flow outfall concentration (June 2010) and the June chronic low-flow conditions ($Q_{upstream}$ – 13.2 cfs, $Q_{outfall}$ = 3.3 cfs, $C_{upstream}$ = 0.068 µg/L; $C_{outfall}$ = 31), the concentration in the Dolores River would be 6.25 µg/L.

As the ability of the ponds to attenuate metals decreases, the concentrations may increase to levels close to the adit discharge concentrations, resulting in Dolores River cadmium concentrations of 9.47 µg/L (December acute low flow), 6.1 µg/L (December chronic low flow), 10.9 µg/L (June acute low flow), and 10.5 µg/L (June chronic low flow).

If the WQS are calculated at hardness 247 mg/L, the standards for cadmium would be 3.74 µg/L (acute) and 0.84 µg/L (chronic). The potential Dolores River concentrations shown above are all significantly greater than the acute and chronic WQS.

Cadmium concentrations in the outfall have been greater than the chronic assimilative capacity (Table A-9 in the WQA) since Fall 2003.


Zinc Concentrations
Concentration (micrograms per liter)
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Adit
Outfall


Cadmium Concentrations
Concentration (micrograms per liter)
60
50
40
30
20
10
0
Apr-01
Sep-02
Jan-04
May-05
Oct-06
Feb-08
Jul-09
Nov-10
Adit
Outfall